CAIV—An Important Principle of Acquisition Reform

CAIV is Ready to be Put Into Place

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The Chairman of the Joint Chiefs of Staff, General John Shalikashvili, has stated in the Chairman's Program Review that the Department of Defense's modernization accounts are underfunded by some $60 billion over the Program Objectives Memorandum (POM) relative to the Services' needs. This is approximately 25 percent of the entire procurement budget over that same period—a very substantial problem.

Today

The Defense Science Board, over the past three years, has made a series of detailed studies investigating the direction in which the DoD should be moving to address future threats to national security. The technology investment and equipment procurement to make these kinds of changes may amount to $30 billion over the POM.

Unforeseen contingency operations are not programmed into the budget development, and while the Under Secretary Of Defense (Comptroller), Dr. John Hamre, has made enormous strides in gaining congressional agreement to fund ongoing contingency operations like Operation Joint Endeavor in Bosnia, it is highly unlikely that the Congress will ever agree to establishing a contingency fund for unforeseen operations.

The cost of high-technology defense systems has been increasing annually for decades, leading Mr. Norm Augustine of Lockheed Martin to formulate his famous first law—"Eventually the entire defense budget will be required to procure a single tactical aircraft." Exacerbating this trend is the likelihood that the defense budget will remain level for the foreseeable future. The Figure accompanying this article graphically portrays the fact that actual budgets passed by Congress realize only about 88 percent of the Department's projection for that year when it is first included in the POM.

With the collapse of the Soviet Union, much of the international stability enforced by superpower confrontation in a bipolar world has disappeared. This has led to the appearance of a broad range of threats from high-tech national opponents, to low-tech terrorist forces, to trans-national movements (such as ideological movements). This increased scope of possible threats has increased the range of demands on the operational forces. Similarly, our national decision to minimize U.S. casualties and to employ force with minimum collateral damage has levied additional requirements—the satisfaction of which will require new weapon systems or significant upgrades to existing systems.

Some Background

If the United States is to maintain a defense establishment adequate to the wide range and dynamic nature of future threats to national security, steps must be taken to make national security more affordable. Fortunately, those steps are being taken in a series of acquisition reform-related initiatives. Secretary of Defense William J. Perry's Military Specifications and Standards (MILSPEC) Reform memorandum of June 1994 provided the umbrella under which a number of performance-based efforts have been initiated, including the establishment of Cost As an Independent Variable (CAIV). Among the three variables of program—cost, schedule, and performance—CAIV is a concept emphasizing cost or unit price as the constant. A program can be managed by allowing all three of these parameters to vary in response to program dynamics, but that requires a very difficult and elaborate management scheme and one that yields poor results. Establishing one of the three as a constant (or independent variable) allows the program manager (PM) to more easily control the program through manipulation of the other two variables.

In any weapon system development program, program managers have those three levers that they can manipulate to control the output of the development: cost, schedule, and performance. During the Cold War, when the United States and our allies operated at a significant numerical disadvantage relative to our most likely adversary, the Warsaw Pact nations, system performance was the independent variable, and system cost was varied (read that as increased) to meet the performance requirements (which frequently included initial operating capability or schedule). As an inevitable result, program costs always increased. Effectively, there was almost no price

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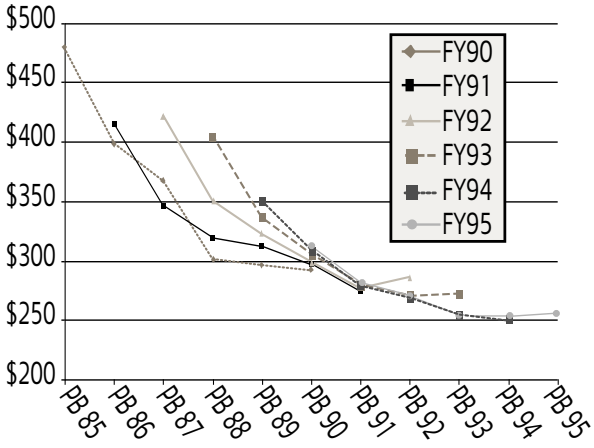
we were unwilling to pay to achieve the required performance.

This performance was amply demonstrated during Operation Desert Storm in which U.S. systems outperformed Warsaw Pact equipment by orders of magnitude. Acquisition of weapon systems under a Performance-As-an-Independent-Variable (PAIV) acquisition philosophy was not a failure. It worked very well, providing U.S. forces with weapon systems that allowed them to rout a numerically equal, combat-experienced, and well-equipped force. The performance of U.S. forces and U.S. weapon systems in Operation Desert Storm was far better than any operations analysis guru would have dared to predict before the battle.

In parallel with the tacit acceptance of PAIV acquisition during the Cold War, the Department of Defense developed an elaborate set of military specifications and standards that explained in elaborate detail not only what to produce, but how to produce it. Like PAIV itself, these specifications and standards were successes. They did exactly what they were intended to do—ensured the production of material to a single, common, and acceptable standard. Nor were these specifications and standards either unneeded or bad. At the time they were first developed, the requirements of the Department of Defense far exceeded the requirements of the commercial marketplace and could only be achieved through detailed specifications that the Department chose to write and maintain itself.

That has changed; the commercial market is demanding performance equal to or better than that needed by the DoD. Industrial associations have joined in establishing commercial standards nationwide and worldwide to meet these performance requirements. Further, industry, recognizing the quality revolution, has begun competing in the quality arena and internally developing high-quality processes as a competitive advantage.

The assumption is that procurement will be fixed in the "out-years" of the current FYDP — historically, DoD has consistently overestimated the TOA available in these years.



Actual Budgets Passed by Congress in Billions

R. Noel Longuemare, Principal Deputy Under Secretary of Defense (Acquisition & Technology), during a Defense Manufacturing Council offsite in November 1994, drew all of this together and coined the phrase "Cost As an Independent Variable." He soon thereafter established CAIV as a principle of acquisition reform and subsequently signed a policy paper mandating the use of CAIV principles in all system acquisition.

So What is CAIV?

Simply explained, CAIV is establishing the affordable price for a system and then trading off either performance or schedule to meet that price. The trick is to define performance very differently than was done under the PAIV concept and in a way that permits the PM and industry to meet the warfighter's real requirements within the constraints of affordability. Under PAIV, system details down to terminology were specified as requirements. This left program managers and their industry counterparts with little or no room within which to maneuver to meet cost constraints.

Under CAIV, system requirements need to be and are being stated in a few broad, top-level terms. The original operational requirements document or ORD for the Joint Primary Aircraft Training System (JPATS), developed in the PAIV time frame, was 140-plus pages long, while the Key Performance Parameters (KPP—those requirements that the PM may *not* trade off) for the Joint Air-to-Surface Standoff Missile (JASSM) are but three: minimum acceptable maximum missile range, mission effectiveness, and aircraft carriers' suitability. While these are very broad requirements, encompassing many lower-level requirements, they are exactly what facilitates CAIV—broad statements of need that can be satisfied in a wide range of ways with a number of, potentially radically different designs. In comparison, the PAIV concept established so many detailed requirements that the PM and industry had virtually no design management room and had to gain requirements community' agreement for any change. This resulted in all competitors proposing essentially the same solution to the requirement and forced the PM to select a winner based solely on frequently poorly understood development or even production cost projections.

Operating under the CAIV concept, the PM can trade off performance for cost as long as the KPPs are met. This means that every opportunity to reduce cost without affecting the KPPs can be made at the program level.

This empowerment simplifies program management and keeps the requirements community involvement at the appropriate level—requirements, not system design.

Doesn't That Mean We'll End Up With 80-Percent Solutions?

By focusing on the real warfighting requirements and allowing industry and the PM to meet those requirements in the most affordable way, CAIV actually increases the probability of fully meeting the requirements. This is true because with ample trade space available to the designer, intelligent trades can be effected quickly and efficiently to trade off lower-level "requirements" to meet the top-level KPPs and meet or reduce costs. An example would be trading off inertial navigation system accuracy for lower cost while achieving total navigation system performance by incorporating a very high-reliability Global Positioning System (GPS) at lower total cost.

Experience in the commercial world, where CAIV has been in place for decades (even if not called by that name), demonstrates that CAIV provides the 100-percent solution and sometimes the 110-percent solution. Lower cost designs are typically simpler and therefore easier to manufacture, more reliable because they incorporate fewer parts, and often provide better performance because the designers find themselves forced to invest more heavily in the intellectual challenges of developing creative designs to meet the cost criteria.

Given a set of broad requirements, any number of designs can meet the need. However, CAIV demands the intellectual investment and provides the discipline needed to develop a creative, elegant design that is absent if performance is the only thing that counts. The creative designs are simpler with better reliability and often better performance.

Isn't CAIV Just Design-to-Cost (DTC) By Another Name?

Design-to-Cost was another of the good ideas developed during the Cold War. Its goal was very much the same as CAIV. The critical difference is that, under DTC, PMs had to meet both cost and performance (including Initial Operational Capability or schedule) requirements. That left them facing a problem in which they were not allowed to vary any of their three classic program management variables: cost, schedule, or performance. Faced with the impossible, the PM routinely failed, and cost increased since the Department was tacitly operating under the PAIV concept and cost was less independent than performance.

As conceived, DTC was not a bad idea. The Department's implementation and the acquisition environment at the time did not provide PMs with the tools to actually control the design cost of their systems. Under the CAIV concept, PMs are provided the tools and are empowered to make trades in low-level system performance to meet cost goals. Further, CAIV explicitly frees two of the program parameters (performance and schedule) to vary to meet costs.

How Do We Know That CAIV Will Work?

For decades, CAIV has worked in the business world. Businesses determine what performance their target customers want and what price they are willing to pay. Business then develops the product with the needed performance at the market price. If business can't produce the product for the market price, they won't market the product. A California-based company decided several years ago to enter the automobile GPS market. They performed a market price analysis and determined that they would have to manufacture GPS receiver/processors (without controls and displays since those components would be part of the integrated automobile system) for $100 or less. They established that as a company goal. Avis car rentals are available with a GPS option today, and the company is making money! There are two interesting sidelights to this story. First, the price of a GPS receiver/processor when the company decided to pursue the auto market was $100,000; and second, the performance of the GPS receiver/processors installed in cars today is significantly better than it was at the $100,000 price. That means that this company was able to achieve higher performance while cutting costs by 99.9 percent!

On a recent visit to the Jet Propulsion Lab, a National Aeronautics and Space Administration Research and Development Center, Longuemare was shown a multispectral spectrometer analogous to a system installed on the Voyager spacecraft. The voyager system cost over $100 million in 1974, weighed hundreds of pounds, and required separate subsystems for different frequency bands. The replacement system, developed under CAIV-like principles ("this is all the money there is"), weighs less than 20 pounds, has a single aperture for all frequencies, and costs less than $8 million in 1996 dollars—well over a 95-percent cost reduction with improved performance.

Terry Little, the former program director for the Joint Direct Attack Munition (JDAM) used CAIV principles in keeping JDAM production costs down. The JDAM program's initial unit price estimate was in excess of $42,000 at the 18,000th unit. After aggressively trading off subsystem performance for cost, JDAM awarded a contract for the full performance at less than a third of the initial cost estimate. This contract price also included a 20-year warranty.

We know that CAIV will work because it is working in DoD and in the commercial world today!

What Happens When the KPPs Can't Be Met?

When industry cannot meet the KPPs with their best efforts, then there are only two possible courses of action: cancel the program as unaffordable or increase the unit price threshold. Either of these decisions is, of course, a major acquisition decision requiring agreement by the acquisition executive and the requirements owner—for

ACAT 1D programs, that would be the Defense Acquisition Executive and the Chairman of the Joint Requirements Oversight Council—co-chairing a Defense Acquisition Board. Canceling the program might seem extreme, but if the acquisition system is working right, and the KPPs are true warfighter requirements, then the minimum acceptable performance has been established. Therefore, if the Department elects not to increase the program funding (i.e., accept a higher unit price), there is no reasonable choice except to cancel the program—procuring a system that does not meet the requirements is a waste of the taxpayers' money.

How Does CAIV Fit With Other Acquisition Reform Initiatives?

Perry's MILSPEC reform initiative set the stage for a move to strict performance specifications. Under that aegis, the Department developed the Single Process Initiative to permit companies to reduce their overhead and manufacturing costs by eliminating duplicate processes. This accelerated realization of the savings implicit in MILSPEC reform. By rewriting the DoD 5000 series instructions, the Department streamlined the mandatory government procedures for managing acquisition programs thereby reducing program cycle times. Complementing the DoD 5000, the DoD Deskbook provides a wide range of best practices, alternative strategies, and good ideas to facilitate better program management. The open systems initiative sets the stage for standard interfaces, providing industry the opportunity to design and manufacture systems more cost effectively. Finally, the move to commercial standards leverages the enormous investment the nation has made in technology and productivity and makes it available to defense programs.

All of these initiatives open the door for industry to cut costs and continue cutting costs. So, CAIV takes advantage of all of the acquisition reform initiatives and would, in fact, be very difficult to implement and much less effective without those initiatives.

What's Next?

The Department of Defense is ready to put CAIV into practice. The implementing initiatives are in place. The policy has been signed out. The only thing remaining is for the requirements and acquisition communities to implement CAIV—set cost goals and stick to them. Work with industry to set and achieve those goals. If the acquisition community is successful in implementing CAIV and achieving results like those realized by business, by the Jet Propulsion Laboratory, and by the JDAM program, we can underwrite Shalikashvili's modernization needs and the Defense Science Board's recommended redirection to meet future scientific and technological needs. As importantly, we can do so without increasing the defense budget or the annual budget deficit.

More About CAIV

The Office of the Secretary of Defense CAIV Working Group is available on the World Wide Web Acquisition Home Page at the following Uniform Resource Locator:

http://www.acq.osd.mil/api/asm/docs.html

This document is available in MS Word 6.0 and can be accessed by either PC or Macintosh computers.

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